Yukon 15

Public Building Retrofit

CREDA is a program which has been jointly funded by Energy, Mines and Resources, Canada and the Yukon Government, Department of Economic Development and Tourism. For more information or copies of reports contact the Energy and Mines Branch, Yukon Government, Box 2703, Whitehorse, Y1A 2C6.

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FOREWORD

The availability of secure and affordable energy supplies is a subject of national concern. Our primary energy sources are becoming more costly and less accessible. However, Canada has both the resources and technical expertise needed to develop renewable and alternate sources of energy.

The governments of Yukon and Canada have entered into a Conservation and Renewable Energy Demonstration Agreement as one means of pursuing this end. Cost shared by the Territorial and Federal governments, CREDA has a budget of $3.3 million and is dedicated to the development and demonstration of conservation and renewable energy technologies.

The objectives of CREDA are:

- To develop and demonstrate promising new technologies, which, when widely adopted, will exploit renewable resources, conserve energy and/or use energy more efficiently,
- To develop broad public awareness of the potential of renewable energy and conservation technology,
- To provide opportunities for the commercial application of the technologies,
- To create economic spin-off benefits for manufacturing, industry and commerce and
- To create employment in new or existing energy-related industries.

The T.C. Richards building retrofit project which is discussed in the following pages is an important attempt to promote energy efficient conservation measures in retrofitting of public building. A large proportion of Canada's energy resources are expended, particularly in the northern climates, in heating poorly insulated public and community buildings. This project and others undertaken in different jurisdictions could significantly reduce the use of fuel oil involved in heating these buildings.

EXECUTIVE SUMMARY

The following report demonstrates the economic viability of cost effective, energy efficient retrofitting of a public building. The Whitehorse Chamber of Commerce in conjunction with the Canada/Yukon Conservation and Renewable Energy Demonstration Project undertook the demonstration project.

The project involved a complete renovation of the T.C. Richards building which was originally constructed as a residence in 1941. It was renovated both on the interior and exterior to house a high quality visitor reception centre for the Whitehorse Region as well as to provide office space for approxiamtely 10 non-profit organizations.

The energy conservation features included increasing the insulation in the walls and ceiling, providing a six millimetre polyethylene air-vapour barrier and installing triple glazed windows on the north side. Also, an air-to-air heat exchanger and a combination wood/oil furnace were installed. However, neither of these latter features have been used since the completion of the renovations. In total, the features cost approximately $26,300.

The energy conservation measures yielded less energy savings than expected. While heating oil use decreased, electrical use increased dramatically. Overall the building achieved a 23 percent reduction in

heating requirements. Reasons for the low yield in energy savings can be attributed to the improper installation of the air-vapour barrier and not using the wood boiler.

The main benefits of the project were to demonstrate the cost-effectiveness of energy efficient construction and to demonstrate energy conservation construction methods to local contractors.

Résume pour l'exécutif

Le rapport suivant démontre la viabilité économique de la rénovation d'un édifice publique visant à le doter d'un très haut rendement énergétique. Le projet de démonstration a été entrepris par la Chambre de Commerce de Whitehorse conjointement avec le projet Canada/Yukon de démonstration sur la conservation et l'énergie renouvelable.

Pour mener le projet à bien, il a fallu entièrement rénover l'immeuble T.C. Richards, construit en 1941 comme résidence particulière. L'immeuble a été rénové à l'intérieur et à l'extérieur dans le but de créer un centre d'acceuil de qualité supérieure pour les visiteurs de la région de Whitehorse ainsi que de fournir de l'espce de bureau à une dizaine d'organisations à buts non-lucratifs.

Les mesures visant à la conservation de l'énergie incluaient la ré-isolation des murs et du toit, la pose d'un coupe vapeur en polyéthylène d'une épaisseur de 6 milimètres pour rendre l'immeuble étanche à l'air et l'installation de fenêtres à triple vitrail du côté nord. On a aussi procédé à l'installation d'un échangeur de chaleur air-à-air et d'une chaudière pouvant fonctionner au bois ou au mazout. Cependant aucun de ces deux derniers éléments n'a été utilisé depuis l'achèvement des travaux. Au total, toutes les mesures visant à conservation de l'énergie ont coûté environ 26.300$.

Les mesures visant à la conservation de l'énergie ont entraîné des économies d'énergie moindres qu'il n'avait été anticipé. Bien que la consommation de mazout ait diminué, celle de l'électricité a augmenté de façon dramatique. En tout, les besoins de chauffage pour l'immeuble ont diminué de 23%. Les raisons pour lesquelles l'économie d'énergie n'a pas atteint le niveau anticipé sont que la couche de polyéthylène n'a pas été posée correctement et que l'on

n'utilise pas la chaudière au bois. Les principaux bénifices de ce projet ont été la démonstration de rentabilité de construction à très haut rendement énergétique et la démonstration pour les entrepreneurs locaux des méthodes de construction visant à la conservation de l'énergie.

INTRODUCTION

The Whitehorse Chamber of Commerce in conjunction with the Canada/Yukon Conservation and Renewable Energy Demonstration Program undertook a project to demonstrate cost effective, energy efficient retrofitting in a public building. The demonstration project was co-ordinated with the Chamber's plans to renovate both the interior and exterior of the T.C. Richards building.

The T.C. Richards building is located at the corner of Steele Street and Third Avenue in the City of Whitehorse, Yukon. The log building which was originally constructed as a residence in 1941 was renovated to house a high quality visitor reception centre for the Whitehorse region as well as to provide office space for approximately 10 non-profit organizations. The building is known locally as the Whitehorse Information Office. It is managed by the Whitehorse Chamber of Commerce; they rent available office space to the community organizations to cover the operational and managerial costs of the building.

The goal of the Whitehorse Chamber of Commerce was to renovate the T.C. Richards building to upgrade the tourism image and appeal of Whitehorse as a major destination centre for the travelling public. The Yukon Government was requested by several private and public sector groups to demonstrate the Government's commitment to tourism development through participation in the upgrading program. Their commitment to tourism development was evidenced by the Canada/Yukon Tourism Agreement signed with the Whitehorse Chamber of Commerce as well as the CREDA Agreement.

The main goal of the CREDA demonstration project was to support and encourage energy conservation in the development of new tourism facilities, services and attractions.

The total capital costs for upgrading and renovating the exterior and interior of the building was estimated as $356,000. The Yukon Government and the Whitehorse Chamber of Commerce signed a Canada/Yukon Tourism Agreement for $267,000 which would cover up to 75 percent of the total eligible costs for the renovations. The actual cost of the project was $366,007 with a cost overrun of only $10,000.

The construction plans were modified to incorporate energy conservation features such as extra insulation, installation of an air-vapour barrier, a wood-fired boiler combined with an oil backup unit and an air-to-air heat exchanger in the ventilation system. These measures cost approximately $26,331.13 and were provided under the CREDA Agreement.

PROJECT DESCRIPTION

The T.C. Richards Building is owned by the Yukon Government and leased to the Whitehorse Chamber of Commerce. The lease is for 10 years commencing November, 1981 and is renewable for a further period of seven years. Under the terms of the lease, the Whitehorse Chamber of Commerce basically gains free rent in exchange for paying the taxes, local improvement rates and assessments and all public and heating utility charges. Therefore, it was perceived to be in their best interest to reduce the energy consumption of the building by incorporating energy conservation features in the renovations and thereby gaining dollar savings through lower utility charges.

The Whitehorse Chamber of Commerce have full managerial and operational responsibility for the building. The main floor of the building and a portion of the basement is used essentially as a visitor reception centre. The Centre contains a variety of display areas, audio-visual features and travel counselling services intended to promote and enhance the tourism appeal of the Whitehorse Region. The remaining space in the building is used by other community agencies and organizations; many of these organizations provide tourism related services as well.

While the renovations to the building were extensive, at the same time, it was felt essential to preserve the historical profile of the building. Photograph 1 graphically displays the "rustic" design chosen to maintain the desired aesthetics of the building.

PHOTOGRAPH 1

T.C. RICHARDS BUILDING

The energy conservation features incorporated into the renovations to replace features in the original plans which would have yielded less energy savings are outlined below.

1. Increased levels of insulation provided on all exterior walls from RSI-2 to RSI-3.5. The ceiling was redone to RSI-10.5. The structural frame also was upgraded from 2 x 4 framing to 2 x 6.
2. A six millimetre (mm) polyethylene air-vapour barrier was installed instead of a four mm polyethylene barrier. All joints were to be properly lapped at least the distance between studs, folded and taped to provide an airtight seal.
3. Triple glazed windows were installed on all north facing windows instead of double glazed.
4. Installation of a wood fired boiler with oil backup including Franks Piping BNH FPW 175, 157 MBH net output with relief valves, draft control and motorized air damper.
5. Heat recovered from 500 litres per second ventilation air by means of an air-to-air heat exchanger equal to Lossnay LP-200 complete with motors, blowers, filter and element.
6. Honeywell 8043 F 1036 3/4" control valves and Honeywell T-8082 fuel saver thermostats with 24 volt control transformer and related wiring provided in each room.
7. Installation of 200 amp three phase electrical service.

Initial planning and design for the renovations began in the spring of 1981. Construction work commenced in October of the same year and the renovations were completed in August, 1982.

PERFORMANCE

Electrical Use

Tables 1 and 2 show the amounts of electricity used (excluding the outdoor auto plugs) by the T.C. Richards building before and after the retrofit demonstration project. Records of the electrical bills after the retrofit are available only for the period of September, 1982 to June, 1983. Therefore, a comparison was made between the electrical consumption during this period and the consumption during the same period prior to the retrofit.

For a nine month period between the months of September to May, electrical use increased from 10,640 kilowatt hours (kWh) prior to the retrofit to 26,240 kWh following the renovations. This is an overall increase of 15,600 kWh which is astonishingly high. Since the number of organizations located in the building did not vary substantially following the renovations, the increase in electricity cannot be a function of increased occupancy and changes in daily use patterns. Neither can the increase be attributed to the energy conservation measures. Even though the electrical system required upgrading to operate the air-to-air heat exchanger, the required increase was calculated to be minimal. Furthermore, the Whitehorse Chamber of Commerce indicated that the air-to-air heat exchanger has not been used since the renovations were completed.

It is predicted that the increase in electrical consumption is a direct result of the new lighting system installed as part of the interior

TABLE 1

ELECTRICAL CONSUMPTION BEFORE RETROFIT

Billing Period	Number of Days	Quantity in Kilowatt Hours
July 8 to		
August 7, 1980	30	1,100
September 8	32	980
October 8	30	1,360
November 7	30	1,060
December 8	31	1,080
January 8, 1981	31	1,120
February 9	32	1,140
March 10	29	1,580
April 7	28	1,140
May 8	31	1,020
June 3	26	1,140
July 8	29	1,320
August 10	33	980
September 9	30	1,220
October 6	27	1,220
November 9	34	920
December 8	29	700
January 12, 1982	35	440
February 8	27	0
March 9	29	360
April 7	29	1,040
May 7	30	1,600
June 8	32	2,580
July 9	31	2,640
August 9	31	3,160
September 9	31	3,180

Source: Records of electrical bills provided by the Whitehorse Chamber of Commerce.

TABLE 2

ELECTRICAL CONSUMPTION AFTER RETROFIT

Billing Period	Number of Days	Quantity in Kilowatt Hours
September 9 to October 8, 1982	29	2,400
November 9	32	2,900
December 8	25	2,880
January 10, 1983	33	2,880
February 7	28	3,020
March 8	29	3,700
April 11	34	3,420
May 9	28	2,480
June 8	30	2,560

Source: Records of electrical bills provided by the Whitehorse Chamber of Commerce.

renovations. The level of illumination provided by the old lighting system was sufficient to adequately light the office spaces and it appears that the upgraded system is far too expansive. This results in both "over lighting" the building and a waste of money. For the nine month period after the retrofit, the additional electricity cost $1,326.00 (assuming a 1983 price of .085¢ per kWh).

Of significance also, is to bear in mind that the lighting system produces heat as well as providing light. The economic analysis of the energy conservation features must take this factor into account.

Therefore, the amount of heat energy the lighting system contributes to the total heating requirements of the building must be added to the annual amount of heating oil used in order to calculate the energy savings of the retrofit project. These calculation are discussed in detail in the Economic Analysis section.

Heating Oil Use

Tables 3 and 4 show the amounts of heating oil consumed before and after the retrofit. Records of the fuel oil deliveries were provided by the Whitehorse Chamber of Commerce over a lengthy period of time. This allows comparing the total yearly heating oil consumption "before" and "after" the retrofit as well as comparing how much heating oil was used during the winter and summer seasons.

The period of highest consumption is, of course, during the winter months from October to March. Following the retrofit and during these months of the 1982/83 winter, approximately 7,915 litres of oil were used; during the same months of the 1983/84 winter, approximately 8,328 litres were used. Before the retrofit and during these winter months in 1980/81, approximately 11,410 litres of heating oil were needed. From these figures, it appears that the energy conservation measures produced an energy saving of approximately 3,300 litres. The annual dollar savings based on an heating oil price of .445¢ per litre would be $1,468.50. However, this calculation does not take into account the heat generated by the lighting system which is discussed in detail in the Economic Analysis section.

TABLE 3

HEATING OIL CONSUMPTION BEFORE RETROFIT

Date	Quantity in Litres
August 26, 1980	227
September 29	840
October 20	365
November 13	1,168
24	601
December 4	716
8	444
15	775
18	295
22	548
29	864
January 1, 1981	408
15	539
26	554
February 9	944
16	527
24	508
March 9	723
23	682
April 9	749
29	896
May 19	118
August 31	127
September 24	373
October 15	786
November 2	448
13	736
23	368

Source: Records of fuel oil deliveries provided by the Whitehorse Chamber of Commerce.

TABLE 4

HEATING OIL CONSUMPTION AFTER RETROFIT

Date	Quantity in Litres
September 13, 1982	957
October 7	488
25	643
November 4	487
15	467
25	532
December 6	531
16	382
23	382
January 4, 1983	507
13	717
20	340
31	662
February 10	456
21	589
March 2	310
17	510
30	400
April 8	545
20	380
May 11	365
September 9	479
October 10	633
November 2	702
9	270
17	368
December 1	665
15	890
22	415
29	709
January 5, 1984	396
12	414
19	291
26	531
February 2	317
16	619
March 1	522
22	586
April 19	734
June 7	794

Source: Records of fuel oil deliveries provided by the Whitehorse Chamber of Commerce.

Airtightness Testing

Upon completion of the energy conservation retrofit, an air infiltration test was conducted by a consultant on August 26, 1982. Using air pressure test conditions of 50 Pascals (Pa), the consultant determined that the building experienced eight air changes per hour (ACPH). Since a rate of three ACPH would be considered acceptable on this type of retrofit, it was concluded that the air-vapour barrier was not properly sealed. Evidence of improper installation of the barrier was supported by observations during site inspections of numerous flaws and holes in the six mm polyethylene. During one inspection, four mm polyethylene was observed on the construction site indicating the possibility that lesser grade material may have been installed as well.

Although the air pressurization test showed a substandard level of airtightness, it should be pointed out that recommended standards can vary. For example, the Canadian General Standards Board recommends a standard for energy efficient housing of two to 2.5 ACPH at 50 Pa of air pressure. Another standard which is recommended by Energy, Mines and Resources Canada for the normal conserver (R-2000) home is a rate of 1.5 ACPH at 50 Pa of air pressure.

In the final analysis, however, it must be concluded that the building is not in accordance with the airtightness requirements specified in the CREDA Agreement. The demonstration project, although not as successful as desired, certainly stresses the need for careful installation of the air-vapour barrier if energy efficient construction is to reap significant savings.

BUDGET REVIEW

The estimated and actual costs of the energy conservation measures are shown in Table 5. The Whitehorse Chamber of Commerce estimated the costs to be $27,350 broken down for each item as indicated in the Table. It is difficult to accurately assess what the measures cost because of considerable differences between figures presented by the contractor and those provided by the Yukon Government's financial auditor. Figures provided by the contractor total $36,178.27 while the Auditor's cost pricing totals $18,123.73.

Recepients of the CREDA program often have difficulty determining the actual cost of the conservation measures separate from the general costs of the renovations. With this particular demonstration project, there were a number of problems with cost overruns and misunderstandings regarding reimbursement commitments under the CREDA Agreement.

In summary, the Auditor was able to substantiate an expenditure of $18,123.73 on some of the energy items compared to a claimed expenditure of $27,970.87 for the same items. The Auditor pointed out that the remaining three items were unsubstantiated as documentation was not available; however, these expenditures were within the budget amount. From these figures, it was concluded that actual costs of $26,331.13 were incurred for the energy project.

TABLE 5

ESTIMATED AND ACTUAL PROJECT COSTS

Item	Estimate Included In Tender	Actual Price	Audited Price
Provide 2 x 6 framing and RSI-3.5 fibreglass insulation in lieu of 2 x 4 studs and RSI-2 insulation on all exterior walls	$ 4,600.00	$ 4,757.40	N/A
Instead of 4 mil poly vapour barrier on all exterior walls provide 6 mil polyethylene; lap, fold and tape all joints to provide an airtight seal	$ 1,800.00	$ 930.00	N/A
Provide triple glazing for all north facing windows in lieu of double glazing	$ 2,500.00	$ 2,520.00	N/A
Provide wood/oil fired boiler in lieu of oil fired unit; use Franks piping BNH FPW 175, 157 MBH net output with relief valves, draft control and motorized air damper	$ 6,250.00	$ 8,642.00	$ 5,660.00
Delete air handling unit and related controls and provide air to air heat exchanger equal to Lossnay LP-200 complete with motors, blowers, filter and element. Duct all exhaust air to heat exchanger and provide a seven day time clock to stop and start	$ 2,250.00	$ 9,409.89	$ 4,199.91
Delete Danfoss control valves and provide Honeywell 8043 F 1036 3/4" control valves and Honeywell T-8082 fuel saver thermostats, c/w 24 volt control transformer and related wiring for each room	$ 5,100.00	$ 5,242.08	$ 4,366.40
Determine adequacy of electrical service relative to above items and provide increased service and distribution as required	$ 4,850.00	$ 4,676.90	$ 3,897.42
Total	$27,350.00	$36,178.27	$18,123.73

N/A - Supporting documentation not provided to the Auditor.

ECONOMIC ANALYSIS

Before taking into consideration the effect of the lighting system on the total heat requirements of the building, a review of the savings of only the heating fuel is provided. Correlations of heating oil consumption with the number of degree days for Whitehorse provides the following information:

1. Pre-retrofit Heating Fuel Consumption (August 26, 1980 to August 31, 1981)

Quantity of heating oil	13,391 litres
Degree days below 18°C	6,428
Litres per degree day	2.1

2. Post-retrofit Heating Fuel Consumption (January 4, 1983 to January 5, 1984)

Quantity of heating oil	10,801 litres
Degree days below 18°C	7,162
Litres per degree day	1.5

3. Annual Savings

Reduction in heating oil consumption	29 percent
Reduction in heating oil consumption accounting for eight percent increase in total heated volume space	33 percent
Annual savings based on 6,989 degree days per year in Whitehorse and a heating oil price of .445¢ per litre	$1,866.06
Simple payback period	14.1 years

To accurately assess the economic benefits gained from the energy conservation measures, the amount of heat produced by the lighting system should be included within the total heating requirements. For the purposes of this report, it is assumed that heat energy from the lights contributes to the overall heating requirements of the building during the coldest months of the year, inclusive between September to April. During the summer months, the extra heat may be ventilated to the outside; therefore, the electricity consumed during the remaining months of the year are not included in the calculations.

From Table 1, Electrical Consumption Before Retrofit, it is estimated that the building used approximately 9,500 kWh of electricity during the 1980/81 winter months. This equals 34.2 gigajoules (GJ) of energy which is comparable to 855 litres of heating oil.

During the winter months of 1982/83 which followed the completion of the retrofit, it is estimated that the building used approximately 23,680 kWh of electricity (see Table 2, Electrical Consumption After Retrofit). This is equal to 85.2 GJ of energy which is comparable to 2,130 litres of heating oil.

The annual heating requirements of the building equals the electrical equivalence of heating oil plus the quantity of heating oil used. These figures were correlated with the number of degree days for Whitehorse to perform the following calculations and determine the adjusted energy savings.

1. Adjusted Pre-retrofit Heating Fuel Consumption (August 26, 1980 to August 31, 1981)

Quantity of heating oil	14,246 litres
Degree days below 18^{o}C	6,428
Litres per degree day	2.2

2. Adjusted Post-retrofit Heating Fuel Consumption (January 4, 1983 to January 5, 1984)

Quantity of heating oil (includes the electrical equivalence for the 1982/83 winter months)	12,931 litres
Degree days below $18^{o}C$	7,162
Litres per degree day	1.8

3. Adjusted Annual Savings

Reduction in heating oil consumption	18 percent
Reduction in heating oil consumption accounting for eight percent increase in total heated volume space	23 percent
Annual savings based on 6,989 degree days per year in Whitehorse and a heating oil price of .445¢ per litre	$1,244.04
Simple payback period	21.2 years

By adjusting the annual savings gained from the energy conservation measures provides a more realistic assessment of the economic benefits achieved by the demonstration project. The above calculations indicate that for a cost of approximately $26,350.00, an annual saving of approximately $1,250.00 is gained. The simple payback period on the cost of the measures is 21 years.

In order to determine the effect of the setback thermostats on fuel consumption, it is necessary to assume that the daytime temperature settings are approximately the same prior to and after the retrofit. The thermostats are set back an average of 5°C for an average of 12 hours per day. Using the standard that a 1°F setback for eight hours a day will yield a one percent reduction in fuel consumption, the following calculation can be made:

1. Effect of Retrofit Without Setback Thermostats

Reduction in fuel consumption	9.5 percent
Annual savings	$513.84
Simple payback period	44.8 years

2. Effect of Retrofit with Setback Thermostats

Reduction in fuel consumption	13.5 percent
Annual savings	$730.20
Simple payback period (setback thermostats cost $3,332.88)	4.6 years

The above analysis indicates that greater savings are achieved from the setback thermostats than from the other energy conservation measures (air-vapour barrier, extra insulation and triple glazed windows). Since the wood boiler and the air-to-air heat exchanger are not used, the annual savings from these features are zero; however, they may be operated in the future to lower heating costs.

IMPACTS

The flow of economic benefits from energy savings produced by the energy conservation measures are less than expected. However, the T.C. Richards building is consuming less heating oil energy than prior to the demonstration project.

The retrofit and renovation projects generated direct economic benefits by providing income for local contractors and building suppliers during the construction period of approximately 10 months.

The environmental and social impacts of the demonstration project are insignificant in terms of energy conservation; although, the entire renovation project certainly contributes positively to Yukon's tourism trade.

CONCLUSIONS AND RECOMMENDATIONS

The energy conservation measures yielded less energy savings than expected. Although the T.C. Richards building is now consuming less heating oil (33 percent less); the amount of electricity used has increased by 146.6 percent. Overall the building achieved a 23 percent reduction in heating consumption (this figure takes into account the heat energy generated from the lighting system).

There are several reasons for the unsatisfactory performance of the demonstration project and several factors are discussed for information purposes only. One of the main reasons underlying the poor performance can be traced to the improper installation of the air-vapour barrier. Due to improper sealing and ripping during the interior renovations, the barrier is basically ineffective. The air-vapour barrier is as significant in terms of fuel savings as is insulation. It is believed that fuel savings in the order of 50 to 70 percent could have been achieved if careful attention had been paid to the correct procedures when installing the air-vapour barrier.

Another reason relates to the combination wood/oil furnace. While the furnace, itself, cost $5,000; as far as can be determined, the wood burner has never been used. Heating the building with cord wood during the daytime hours when the offices are occupied could reduce the fuel costs by $1,000 to $1,500. The Whitehorse Chamber of Commerce and the non-profit organizations renting space within the building could generate

a far greater impact on Yukon's economy by burning wood instead of oil. For example, according to Marvin Shaffer & Associates Ltd., in their study, The Economic Impact of Selected Energy Sources in Yukon (1984), an equal $1 million expenditure on oil and cord wood would produce the following impacts:

	Local Economic Impact	Job Creation
Oil	$ 130,000	2.7 person years
Wood	$1,120,000	50.3 person years

It is believed that the obstacles to wood burning, such as the need to stoke the fire, pack in wood, etc. can easily be overcome.

The final point deals with the setback thermostats. A survey of settings indicated that day time temperatures were programmed as high as 27°C; night time temperatures ranged from 10 to 18°C and the length of setback varied from eight hours to 14 hours. Some of the tenants were unaware of the devices and unsure of how they worked.

Significant incremental savings can be attained by properly setting the thermostats. The average day time setting is 21°C and the average night setting is 15.5°C. Both temperatures could be moved back with no effect on comfort to 18°C which is a recommended day time temperature in Canada and it provides a comfortable working environment. Since no one is in the building at night, a setting of 10°C is acceptable. The thermostats can be set to ensure that the offices are up to 18°C by the time the first tenants arrive which takes no more than 30 minutes for preheating.

These measures alone would result in a further reduction in fuel use of 20 percent and an energy saving of $1,000 annually.

Although the T.C. Richards Building demonstration project was not as successful in reducing energy use as originally calculated, it was significant in demonstrating how important it is to properly fold, tape and seal the air-vapour barrier. Therefore, the benefits of the project are twofold -- firstly, to demonstrate the cost-effectiveness of energy efficient construction and, secondly, to demonstrate to local contractors the methods which must be employed when installing the air-vapour barrier to achieve energy efficient construction.

Energy, Mines and Resources Canada | Énergie, Mines et Ressources Canada

Yukon
Department of Economic Development and Tourism

PUBLIC BUILDING RETROFIT

Final Project Summary

Canada/Yukon Conservation and Renewable Energy Demonstration Program

Project No.
3766-4-16

Date:
January 1982

Sectors:
Buildings

Project Locations:
Whitehorse, Yukon

Technology:
Conservation

Jurisdiction:
Yukon

Project Manager:
Robert E. Collins

Status:
Complete

Simple Payback:
21 years

Purpose:

To demonstrate cost effective energy efficient retrofitting in a public building.

Description:

The T.C. Richards building, constructed as a residence in 1941, will be renovated to house a visitor reception centre and the offices of approximately 10 non-profit organizations. In conjunction with the renovations, the building will also be retrofitted with energy conservation features including extra insulation, airtight vapour barrier, wood fired boiler and air-to-air heat exchanger.

Contributors:

Canada/Yukon	$ 27,350
The entire project cost	$ 366,000

Demonstrated Benefits:

1. This project demonstrates the cost effectiveness of energy efficient construction.
2. Local contractors will become familiar with the methods employed in efficient construction.

Further Information

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Economic Analysis:

Energy savings	111.84 GJ
Annual heating fuel savings	1,796 litres
Annual savings	$ 1,244.04
Cost of retrofit	$26,331.13
Simple payback	21 years

Information Transfer:

A final report will be produced detailing the energy conservation measures taken in the retrofit.

Technical Details:

Walls of the building are of log. 141 mm fibreglass batts (RSI 3.5) will be added to the inner surface with 0.15 mm vapour barrier installed, lapped at least the distance between studs, folded and taped. Ceiling will be redone with 461 mm fibreglass (RSI 10.5). Heat will be recovered from 500 l/s ventilation air by means of an air to air heat exchanger. Heat will be provided for the building by a wood boiler with oil backup.